
NABC 8: An Overview

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A major attraction of biotechnology for investors has been the allure of new market opportunities and the prospect of revolutionary medical, food, and other products that will change our lives. However, biotechnology's critics have long expressed concern that the unpredictability of the effects of such changes are reasons for prudence and caution. In spite of some false starts, unrealistic expectations, and unfulfilled promises, recombinant DNA biotechnology is now maturing as an important discipline that will underpin much of our biological research and development during the next century. Surprising to some is the important role of agricultural biotechnology to not only the food and feed industry, but also to the chemical, pharmaceutical, environmental, and energy industries, as new products are emerging in these marketplaces.

Agricultural biotechnology is beginning to act as a matchmaker for some unexpected marriages between sectors. The National Agricultural Biotechnology Council's (NABC) eighth annual meeting — Agricultural Biotechnology: Novel Products and New Partnerships — held at Rutgers, The State University of New Jersey, New Brunswick, New Jersey on June 4–7, 1996, debated the social, ethical, economic, research, development, and commercialization issues and opportunities that the new products of biotechnology pose for consumers, farmers, industry, public interest groups, government, and universities. Asked to be provocative and to speculate, 14 plenary speakers from the public and the food, pharmaceutical, and environmental and energy sectors set the stage for intensive workshop discussions of the social and ethical issues raised by new products and the opportunities for structural and economic changes.

Following the plenary sessions, participants in three workshops tackled a set of tough questions from the viewpoints of the food industry, the pharmaceutical industry, and the environmental and energy sector.

PLENARY SESSION HIGHLIGHTS

PLENARY SESSION I: NOVEL PRODUCTS AND NEW PARTNERSHIPS

Kenneth Barton, Vice President for Research, Agracetus, was one of the two keynote speakers. His talk, "Biotechnology: Catalyst for Change in Agriculture," set the stage by pointing out how the application of biotechnology will help to sustain population growth and food production on the earth's finite area of cultivable land. The increased speed and great breadth of current change, along with the relevance of biotechnology to industries other than agriculture, will significantly impact progress in this field. He pointed to the current acceleration of the transition from biotechnology development to product and market development and the unprecedented scope of recent introductions to the marketplace. Barton went on to review the important role that intellectual property protection will continue to have in shaping the biotechnology industry in years to come. The speed of developments in biotechnology was illustrated by the progress made in improving the strength of cotton fibers, with a single genetic engineering step responsible for a strength increase equivalent to that achieved in 30 years of classical plant breeding.

As a counterpoint to the brave new world of biotechnology, the other keynote speaker, Rebecca Goldburg, Senior Scientist, Environmental Defense Fund, spoke of the unknown environmental impacts of biotechnology. She explained the skepticism of the environmental community over promises that fertilizers and pesticides would be replaced by crops that fix their own nitrogen and protect themselves from pests and diseases and benefit the environment. The first have not materialized and engineered resistance has yet to have a significant effect in reducing pesticide applications. She described those claims as greenwashing. In her view, bioremediation has been oversold and pollution prevention will be far more effective in dealing with the problems caused by chemical wastes. Goldburg also expressed continuing concern over the hazards that might result from gene transfer between the growing range of engineered plants and animals and their wild and cultivated relatives. She cited the many examples of escapes from aquaculture facilities, pointing to added risk of transgenic fish to wild populations. And she stressed the importance of conditions attached to recent permits issued by the EPA that can lead to the cancellation of permits. Those conditional registrations represent a step toward the kind of innovative regulations the environmental community seeks to have in place.

Together, the keynote speakers demonstrated the open sharing of diverse views that has become the hallmark of the NABC conferences.

PLENARY SESSION II: CREATING NEW MARKET OPPORTUNITIES FOR AGRICULTURAL BIOTECHNOLOGY

David Evans, Executive Vice-President, DNA Plant Technology Corporation, described the commercial opportunities for tomatoes that stay firm and fresh longer (ethylene-regulated tomatoes, for example, now have a shelf-life of somewhere between 40 and 90 days.) He reviewed the seven different technologies that must be used to achieve this result, noting that all of them are governed by various intellectual property claims that limit a company's ability to commercialize new developments. He underscored the potential impact upon the industry of this increasingly complex and interwoven state of intellectual property rights, citing the challenge of balancing possible obstacles to innovation with companies' need to exert control over intellectual property.

From the pharmaceutical industry, Dianne Defuria, Director of Commercial Development, Bristol Myers-Squibb, discussed the role of industrial-scale plant cell culture technology in relieving her company of its dependence on extracting the anti-cancer drug paclitaxel from the bark of Pacific Yew, which at first was peeled by hand from the trunk and major limbs in natural stands. Interesting issues of high technology facilitating conservation of trees arise from this sort of situation.

Jeff Gain, Chair of the Board of the Alternative Agricultural Research and Commercialization (AARC) Corporation of the USDA, represented the Environmental and Energy sector and discussed industrial uses of agricultural products. He stressed the difficulties in growing industrial hemp without cyclone fences, guard towers, and search lights!

Caron Chess, Director of the Center for Environmental Communications, Rutgers University, discussed the public's interest in agricultural biotechnology and their perceptions of risk. She reviewed the importance of how information is supplied, pointing to the fallacy of the overly simplistic idea that if you give people information it will change their attitude and, in turn, their behavior. Information does not make people agree with what scientific experts might call "rational." An array of additional factors enter into their formation of opinions.

PLENARY SESSION III: SOCIAL ISSUES, REGULATIONS, AND ETHICS

The first speaker, Sister Miriam MacGillis, Director of Genesis Farm, presented a point of view completely opposed to biotechnology as well as other interventions by humans in natural processes. She voiced her concern about world hunger, presenting a view that the lawlessness of the global market system is responsible for the crises of modern society. Her thesis is that an obsession with genetic engineering may bring about a total undermining of the life that biotechnology is committed to redesigning.

In a provocative juxtaposition of presentations, Charles Arntzen, President/CEO, Boyce Thompson Institute, devoted his presentation to the utilization

of biotechnology for fighting disease among children in lesser developed countries. He gave an account of some successful research on the expression of antigenic proteins in transgenic plants that may make it possible to raise vaccines in plants against hepatitis B, bacterial and viral diarrheal disease, and other infections. The objective of this work is to create an oral vaccine that is delivered when the transgenic food plant that expresses it is consumed. The plant of choice is the banana because its fruit is eaten raw and it is a widely accessible and acceptable food in many lesser developed countries.

Ken Evans, President of the Arizona Farm Bureau, described the application of other modern technologies and spoke of his own use of a 300 horsepower sludge injection tractor remotely controlled by a portable computer. Using sensitive biotechnology-based tests to detect and reject loads contaminated with toxic materials and disease organisms, he has applied over three million metric tons of uncontaminated municipal biosolids during the last 18 years, raising the elevation of his 22 square-mile ranch by over three inches! Clearly a believer in the proactive adoption of suitable technologies, Evans predicted that industrial and chemical feedstock production will be a major source of revenue for future farmers, who will be as comfortable on the Internet as yesterday's farmers were using a shovel. He stressed, however, that innovative farming must be done with provision for recreational land use and improved environmental management.

Martine Kraus of the Center for the Study of Law and Society, University of California, Berkeley, described the importance of regulation that assists the development of the biotechnology industry without stifling innovation. A comparison of the experience of United States and German biotechnology companies was revealing as shown by Germany's 20-fold higher regulatory costs. Whereas regulation creates a known climate for companies and assures consumer confidence, it was reassuring to note her conclusion that innovation thrives independent of the regulatory framework.

PLENARY SESSION IV: ECONOMIC AND STRUCTURAL ISSUES

The session began with a talk by Brewster Kneen, an agricultural journalist from British Columbia, who discussed the biases and assumptions implied in the expression "food industry." Stripped of its hyperbole, Kneen reduced biotechnology to a monoculture modeled on the production line. Drawing an analogy between the safety of automobiles and of biotechnology, he highlighted our ability to ignore or eliminate what doesn't fit or what is unknown, and our preoccupation with speed and precision.

Julian Cooper, of PPL Therapeutics, spoke of the value to the pharmaceutical industry of proteins produced in transgenic animals. He used as an example the attachment of a milk gene promoter to a gene encoding a therapeutic protein. The latter is expressed in the mammary gland of the animal so that the transgenic protein can be harvested and purified from its milk with no adverse

effects on the animal. Many therapeutic proteins are modified after translation from DNA in order to be therapeutically active in ways that bacterial expression systems, for example, cannot handle. A case in point is the inability of bacterial systems to add sugar residues to proteins (glycosylation). The yields of transgenic proteins from mammalian tissue culture systems are low, and the costs of establishing them are high, making production by farm animals an attractive mechanism for providing some important pharmaceuticals.

In his talk about the use of plants to remove heavy metals from contaminated soil, Burt Ensley, CEO of Phytotech Inc., spoke about the novel blending of agriculture with the environmental industry. The best results have been obtained with selected forms of an agronomic crop, Indian Mustard, that take up and concentrate toxic metals from contaminated soils. When the plants with high concentrations of metal are harvested, the biomass of plant debris from a contaminated site is only about two percent of the original mass of contaminated soil, decreasing disposal costs while leaving cleaned topsoil in place. The harvested plants can be composted or incinerated to further concentrate the toxic metals. He showed experiments in progress on lead contaminated land in the inner city of Trenton, N.J., where the objective was to render the site safe for other uses in a way that can be perceived by the community as "natural" and "environmentally friendly."

The final plenary paper, by Marylou Garr of the Ontario Federation of Agriculture, presented biotechnology from a farmer's perspective. She described the evolution over the last three years of the Ontario Agricultural Biotechnology Committee. This group was designed to promote knowledge and understanding within the agricultural industry, to improve communication within the agricultural community and between it and society at large, to influence future research and commercialization, and to encourage assessment of and access to biotechnology products for Ontario. Because the rate of discovery of new products is far more rapid than our ability to address the issues that each raises, the committee is already performing a valuable function at the intersection of research and development with farming and the public.

In between the plenary sessions, participants joined one of three workshops. While the plenary sessions described here were designed to stimulate controversy, the real heart of the meeting lay in the dialogues arising in the workshops. In those breakout sessions, participants explored implications of Creating New Market Opportunities; Social Issues, Regulations, and Ethics; and Economic, and Structural Issues for a particular industry sector. Lively debate coupled with mutual respect ran throughout those sessions. The workshop reports begin on page 23.

Those attending the Food Industry Workshop discussed the pathways to be taken by new food products, issues of communication, regulation, and consumer concern over food, and the ways in which the production of new food crops might impact the structure of the agricultural and food industries.